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THE USE OF MAXIMUM ALLOWANCES FOR DEFECTS IN GRAPES TO CONTROL TONNAGE CRUSHED FOR WINE, CENTRAL VALLEY, 1950

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FOREWORD

Quality of wine appears to be determined by several factors: the grape variety; maturity at harvest--measured by degree Balling, acidity, pH, color, and flavor; region of production; seasonal conditions; and condition of the fruit. This study does not measure the relationships of any of these attributes of grapes to quality of wine. It is concerned only with the feasibility of controlling tonnage of grapes crushed by specifying maximum tolerances in terms of a single one of the characteristics of grapes apparently related to quality of wine. Thus, there is no implication that those grapes least affected by the six defects analyzed here necessarily yield the highest quality wine. It is probable that other determinants of wine quality are at least as important, and probably more so, than the defects in terms of which condition of fruit is measured. The single objective of this report is to determine the tonnage of grapes which would be eliminated through various maximum allowances for defects, to estimate the distribution of such elimination among varieties of grapes and areas of production, and to appraise the probable impact of this method of control upon commercial operations.

It is stressed that the data are relevant to a single season. Analysis of other attributes of grapes indicates that there is much variability from one season to another. Thus, the results cannot properly be generalized to other seasons than 1950 or to other areas than the Central Valley. Finally, there are deficiencies in the 1950 sample on which this study is based which limit the generality of the conclusions.

In consequence, this study should be considered as no more than a preliminary report restricted to a single question: how the tonnage of grapes crushed in the Central Valley in 1950 would have been affected by specifying maximum tolerances for a single one of the several determinants of wine quality.

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THE USE OF MAXIMUM ALLOWANCES FOR DEFECTS IN GRAPES TO CONTROL TONNAGE CRUSHED FOR WINE, CENTRAL VALLEY, 1950

George L. Mehren[1] and L. B. Kahn[2]

The Questions

Over the past several years, there have been suggestions that maximum allowances for defects be imposed upon grapes received for crushing in order: (a) to enhance the quality of wine and (b) simultaneously to limit the tonnage of grapes crushed in years of extremely heavy yields, low demand, or high inventories. This study does not engage the first of these objectives. The analysis appraises the feasibility of controlling the tonnage of grapes crushed in the Central Valley through specifying maximum allowable percentages by weight of the following defects: (1) waterberry or redberry; (2) decay, rot, or mold; (3) heat or sunburn damage; (4) raisined or raisining berries; (5) freeze or rain damage; and (6) measles or mildew.[3] Feasibility is defined in terms of: precision with which tonnage eligible for crushing--or tonnage eliminated--can be predetermined; equity of benefits and burdens among varieties, areas, and wineries; and facility of administration.

Effectiveness of any kind of a control program will depend upon the accuracy with which total production of grapes, total tonnage which will be offered for crushing, and the size of the surplus can be predetermined. The success of the proposed quality control will depend additionally upon precision of estimate of the relationship between incidence of defects and tonnage eligible for crushing or of tonnage denied access to the wineries; stability of this functional relationship among varieties, areas of origin, and wineries, within each

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1/ Professor of Agricultural Economics and Agricultural Economist in the Experiment Station and on the Giannini Foundation.

2/ Formerly Assistant Specialist in the Experiment Station.

3/ An industry committee was advised that, aside from production and aging processes, wine quality was largely determined by grape variety; maturity at harvest--degree Balling, acidity, pH, color and flavor; condition of the fruit--decay, mold, rot, mildew, sunburn, raisining, raisins, soil and foreign matter; region of production; and seasonal conditions. Standards were suggested for grapes used in dessert wines and grape spirits: 24° Balling or more; 95 per cent characteristic color for black varieties and 60 per cent for red; not more than 3 per cent by weight of the above-named defects; and not more than 3 per cent for waterberry or redberry, nor more than 1 per cent for decay or discoloration. It was considered that these minimum standards would eliminate roughly the following tonnages in thousands: Emperors, 50-75; Ribier, 25-35; Red Malaga, 15-25; Rish Baba, Olivette Blanche, packing house culls, all "surplus"; and Sultana, 25-50. These results would not have occurred in 1950.

season and over two or more seasons; and degree of interference in business operations of growers and vintners necessitated by the program.4/

The total tonnage of grapes which would have been eliminated in 1950 by use of several alternative levels of tolerance for the listed defects is indicated in this report. The distribution of such elimination among varietal classes, varieties, areas of origin, and weeks of the season is also indicated. Since data were obtained for the 1950 season only, it is not possible to appraise the stability over time of the relationship between incidence of defects and tonnage ineligible for crushing.

The Data and Method of Analysis

Samples were taken in 1950 from 747 loads representing 21 varieties from 32 areas of origin.5/ Distribution by weight of the 450 samples from the Central Valley is shown in Figure 1. Loads were sampled in order of arrival after weighing but prior to reaching the crushers. Samples were handpicked from box loads and forked from tanks or gondolas.

The nature and degree of defects in the samples were approximated through visual inspection by a trained operator from the Federal-State Inspection Service. Estimates were checked by actual berry count in 37 of the 747 samples. Results of visual examination and actual count are compared in Table 1. The visual estimates of defects were highly and significantly correlated with the actual counts. No significant bias was introduced by use of the faster and less costly method of visual inspection.6/ Grapes were ruled defective if the berry were affected by one or more of the six listed defects. Defects were equally weighted. The total weight of grapes ruled defective for any of the defects was expressed as a fraction of the total weight of all the grapes in the sample. The inspector approximated this percentage in his visual estimate.

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4/ Of the six specified defects, four appear to be closely related to weather--decay, rot, or mold; heat or sun damage; freeze or rain damage; and measles or mildew. Prediction of the incidence of these defects may, therefore, depend upon accurate prediction of weather. It is also necessary to know whether the relationship of defects to weather is stable over time. Particular patterns of weather may well be associated with high yields and low incidence of defects. A given maximum allowance for specified defects might in one year involve heavy elimination with low total production. In other years, the same tolerance could involve low levels of elimination with heavy yield.

5/ Average weight per load was 17,827 pounds. Average sample weight was 66.2 pounds with 95 per cent of the samples falling within 51 and 82 pounds. Average weight of Central Valley samples was 68 pounds with a standard deviation of 8.26 pounds.

6/ Coefficient of correlation, 0.9782; t, 27.86.

FIGURE 1

Weight Distribution of 450 Samples from Central Valley

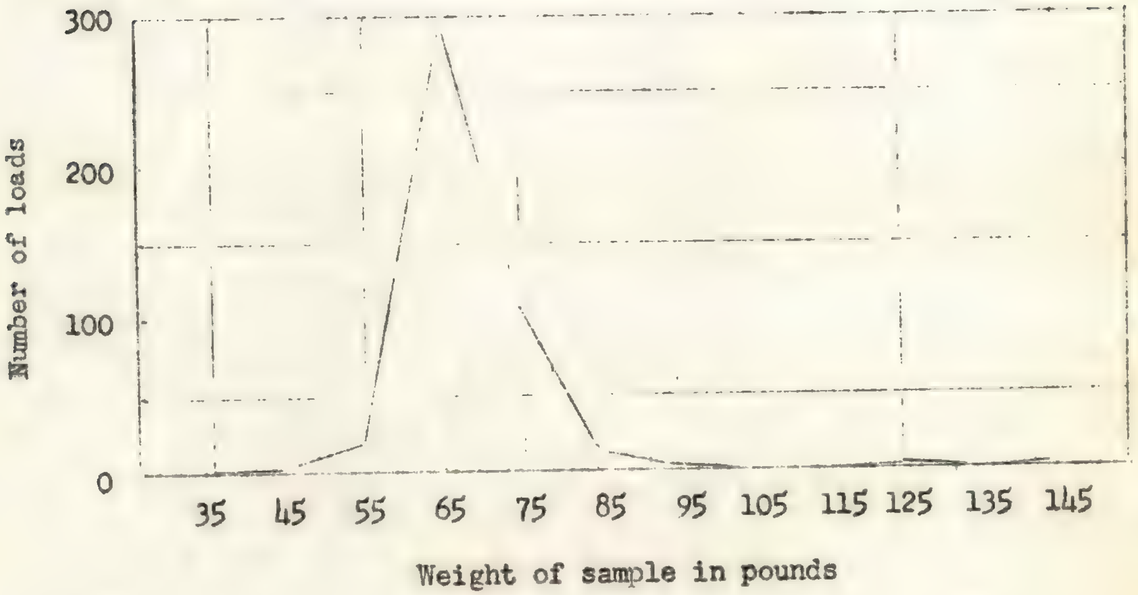

TABLE 1

Incidence in Ounces of 6 Defects in 37 Samples, Visual Elimination, and Direct Berry-by-Berry Count Methods[a]

Estimate	Count	Estimate	Count	Estimate	Count	Estimate	Count
10	8	6	5	27	26	24	21
12	13	3	5	6	4	12	11
18	16	18	17	13	14	14	15
24	21	26	25	25	24	14	16
39	42	20	20	13	11	47	49
14	14	7	6	29	27	17	18
15	13	11	11	37	32	48	45
16	15	12	16	14	12	30	26
6	5	20	21	28	24	30	29
						21	18

a/ Sum of sample weights--2,298 pounds; estimated weight of defective grapes--726 ounces; and weight of defective grapes by count--695 ounces.

The survey covered six counties in the Central Valley; Mendocino, Sonoma, and Contra Costa counties in the North Coast area; and San Bernardino County in southern California. Analysis and conclusions are largely restricted to the Central Valley.7/ The Central Valley data are classified by varietal class, variety, area of origin, and week of the season. Average incidence of defects over the entire season is calculated for all grapes from all areas, for varietal classes and varieties, and for counties and towns from which loads originated. Next, trends of change in the incidence of defects are estimated on the basis of weekly averages for each of the classifications. Then changes within the season in the relative importance of each one of the six listed defects are measured for each classification of the data. The percentages of tonnage which would have been eliminated in each of the major classifications through various maximum allowances of the specified defects are calculated.

There are serious deficiencies in these data. Restriction to a single season precludes measurement of the stability over time of the relationship between defects and volume of production. Gaps in the continuity of data prevent analysis of the north coastal and southern areas. Gaps in the continuity of Central Valley data reduce the reliability of the estimated intraseasonal trends. Finally, variations in size of samples render direct comparison of some of the statistical measures difficult or impossible. Reference will be made as necessary to such deficiencies in discussing the patterns of defects and in appraising the effects of the tolerances upon the total tonnage eliminated and upon its distribution.8/

Average Incidence of Defects.--The frequency of percentages by weight of defects in 450 loads sampled from the Central Valley is shown in Figure 2. Observed recordings of defects per load are classified into frequency class intervals of one percentage point. The number of loads with defects ranging between 0 and 1 per cent is aggregated and the frequency plotted on Figure 2 at .5 per cent, the mid-point of the class. Similarly, frequencies falling between more than 1 per cent and 2 per cent, more than 2 per cent and 3 per cent, etc., are aggregated and the sums plotted at the respective mid-points of the class intervals. Modal frequency was in the 1 per cent to 2 per cent of defects class. The average was 3.12 per cent, and the standard deviation was 2.71 per cent. The bulk of the observations fell in the less than 6 per cent of defects classes. However, the distribution tails out sharply to the right. These very high percentages of defects in general occurred towards the end of the season.

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7/ Staff was insufficient to cover all areas throughout the season. Only two weeks of coverage was obtained for the North Coast and three weeks for one area of origin in southern California. Data for these areas were insufficient to estimate averages by varieties and areas or to approximate intraseasonal trends. The average incidence of the enumerated defects by weight was 2.65 per cent in the North Coast and 1.46 per cent in southern California. These averages are not comparable with those cited in the text for the Central Valley since time of observation, weight, and varietal composition of the samples differ. Data are shown for the two areas in Appendix Tables I and II.

8/ It would have been more useful to obtain continuous data from one region throughout the season. The sharp increase in defects towards the end of the season in the Central Valley precludes use of the data from other areas even to approximate season averages. Sample design in advance of the survey would have avoided these deficiencies.

[illegible] Central Valley.7/ The Central Valley data are classified by varietal class, variety, area of origin, and week of the season. Average incidence of defects over the entire season is calculated for all grapes from all areas, for varietal classes and varieties, and for counties and towns from which loads originate. Next, trends of change in the incidence of defects are estimated on the basis of weekly averages for each of the classifications. Then changes within the season in the relative importance of each one of the six listed defects are measured for each classification of the data. The percentages of tonnage which would have been eliminated in each of the major classifications through various maximum allowances of the specified defects are calculated.

There are serious deficiencies in these data. Restriction to a single season precludes measurement of the stability over time of the relationship between defects and volume of production. Gaps in the continuity of data prevent analysis of the north coastal and southern areas. Gaps in the continuity of Central Valley data reduce the reliability of the estimated intraseasonal trends. Finally, variations in size of samples render direct comparison of some of the statistical measures difficult or impossible. Reference will be made as necessary to such deficiencies in discussing the patterns of defects and in appraising the effects of the tolerances upon the total tonnage eliminated and upon its distribution.8/

Average Incidence of Defects.--The frequency of percentages by weight of defects in 830 loads sampled from the Central Valley is shown in Figure 2. [illegible] tenths of one percentage point. The number of loads with defects ranging between 0 and 1 per cent is aggregated and the frequency plotted on Figure 2 at .5 per cent, the mid-point of the class. Similarly, frequencies falling between more than 1 per cent and 2 per cent, more than 2 per cent and 3 per cent, etc., are aggregated and the sums plotted at the respective mid-points of the class intervals. Modal frequency was in the 1 per cent to 2 per cent of defects class. The average was 3.12 per cent, and the standard deviation was 2.71 per cent. Most of the observations fell in the less than 6 per cent of defects classes. However, the distribution tails out sharply to the right. These very high percentages of defects in general occurred towards the end of the season.

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7/ Staff was insufficient to cover all areas throughout the season. Only two weeks of coverage was obtained for the North Coast and three weeks for one area of origin in southern California. Data for these areas were insufficient to make averages by varieties and areas or to approximate intraseasonal trends. The average incidence of the enumerated defects by weight was 2.67 per cent in the North Coast and 1.46 per cent in southern California. These averages are not comparable with those cited in the text for the Central Valley since time of observation, weight, and varietal composition of the samples differ. Data are shown for the two areas in Appendix Tables I and II.

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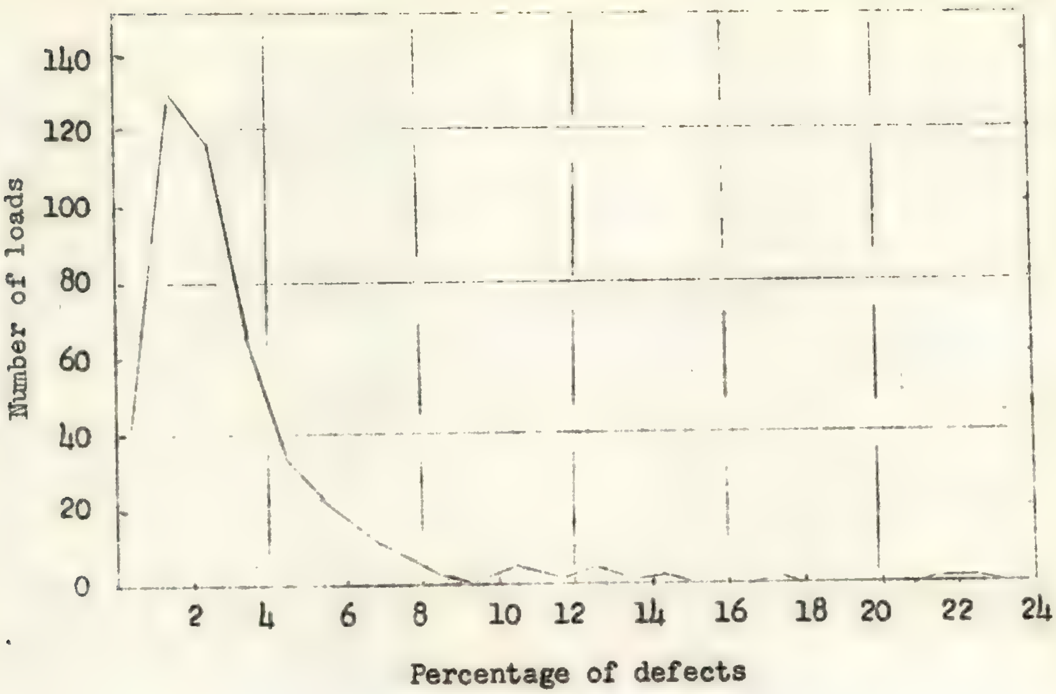
FIGURE 2

Frequency of Percentages of Defects by Weight, 450 Loads
Central Valley, 1950



The seasonal averages of defects are shown for all grapes combined, for varietal classes, and for several varieties in the Central Valley in Table 2. Season average percentages of defective grapes by weight are also shown in Figure 3. Here the length of the lines for each variety or varietal class roughly indicates the confidence interval about the mean of the classification. These confidence intervals may be interpreted as follows: If many samples were drawn from each classification, if averages of the percentage of defects were calculated for each sample, if the confidence interval were calculated about each average, and if for each such range the statement were made that the true mean for the class was encompassed, the statements would be correct in 95 cases out of 100.

There are fairly large variations among the averages of the several varietal classes. However, since the confidence intervals of many of the averages overlap, the differences among such averages are not considered statistically significant by the criteria used here. In fact, the difference of the average for Carignanes is largely responsible for the significant difference between the average incidence of defects in the all-wine grape class and the other classifications shown on Figure 3. Thus, it cannot properly be assumed that the differences in most of the season averages shown are attributable to causes other than random variation in sampling. For this reason, the impact of the various maximum allowances for defects upon areas, varieties, and varietal classes is based upon analysis of individual loads rather than upon averages of the various classes. Analysis of the weekly averages indicates that there is relatively minor differences among varieties or areas in the incidence of defects until about mid-October. Thereafter, heavy appearance of defects results in increasing the season averages for the late-harvested classes in general.

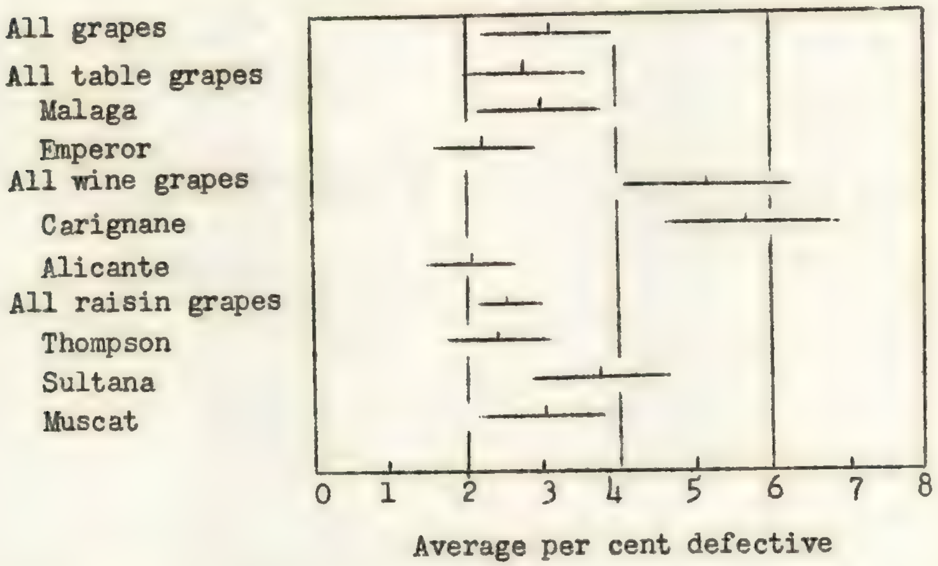
TABLE 2

Estimated Percentage of Defects by Weight, by Areas of Origin, Varietal Classes, and Varieties, Central Valley, 1950

Area	Varietal class				Wine varieties		Table varieties		Raisin varieties	
	All	Wine	Table	Raisin	Alicante	Carignane	Emperor	Malaga	Sultana	Thompson
Central Valley	3.12	5.16	2.78	2.61	2.19	5.78	2.27	3.00	3.79	2.46
Fresno County	2.84	4.54	2.70	2.63	1.74	6.40	2.25	2.93	3.79	2.47
Caruthers	2.62			2.62						2.62
Clovis	2.27		1.60	3.21			1.48	2.81		3.21
Del Rey	1.62	.45	2.95	1.23	.45			2.95	2.65	1.08
Fowler	3.60	5.96		2.64		2.81				2.41
Fresno	3.05	6.04	2.91	2.65	1.61	11.62	2.07	3.13	4.09	2.41
Kingsburg	2.50	2.73	2.61	2.38	2.42	2.70		2.61		2.34
Parlier	3.42	2.15	4.06	3.36			3.95			3.66
Reedley	3.06		3.72	2.34			3.72			2.34
Sanger	2.88	6.39	2.40	2.68		8.64	1.74	4.73		2.65
Selma	2.40	1.77	.94	2.53	1.77			.94	3.42	2.13
Tulare County	5.28	10.40	3.73	3.12		3.56	2.74			3.12
Dinuba	4.17		4.17				4.17			
Exeter	3.53		3.62	3.12			1.41			3.12
Ivanhoe	10.40	10.40				3.56				
Madera County	1.90			1.90						1.84
Madera	1.90			1.90						1.84
Kings County	2.50			2.50						
Hanford	2.50			2.50						
San Joaquin County	6.29	7.58	1.43		2.56	3.43				
Escalon	2.56	2.56			2.56					
Lodi	4.24	4.92	1.42			3.43				
Stockton	8.84	11.74	1.43							
Stanislaus County	4.66	4.78	3.40		3.20	5.62				
Ceres	3.33	3.33				3.33				
Keyes	1.52	1.52								
Modesto	5.11	5.18	3.54		4.59	5.99				
Turlock	3.40	3.47	3.33		1.90	5.11				
Merced County	3.59	4.13	3.51							
Atwater	2.84		2.84							
Livingston	4.03	4.13	4.00							

FIGURE 3

Season Average Defects, Per Cent of Weight, and 95 Per Cent Confidence Intervals, Central Valley, All Grapes Combined, Varietal Classes and Varieties



Estimated season average percentages of defects by weight are summarized in Table 2 for several classifications: district, county, and town; varietal class; and variety. For the Valley, as a whole, the season average incidence of defects was highest in the all-wine varietal class. Incidence was lowest over the season, as a whole, in the raisin varietal class. The season average for raisin grapes at 2.61 per cent was only a little more than half the average of 5.16 per cent for the wine grape class. This difference is partly attributable to the earlier termination in 1950 of raisin grape deliveries to wineries. This same relationship prevailed generally in comparison of particular raisin and wine grape varieties.

In the wine variety group, season average incidence was higher for Carignanes and Zinfandels than for Alicantes or Grenaches. Defects in mixed grapes were lower than in Carignanes in the first six weeks of the season and higher thereafter. In the raisin grape class, Thompsons were consistently less afflicted with defects than Sultanas or Muscats. Among the table varieties, Malagas showed higher percentages of defects than Emperors, Tokays, or culls. After mid-October, Ribiers showed more defects than did Malagas.

There were differences in the incidence of defects among areas of origin due, in part, to differences in relative volume of the several varieties, time of delivery, and relative number of samples. For all varieties combined, the season average for the Valley, as a whole, was 3.12-per cent defects by weight. However, the Fresno County average was only 2.62 per cent, while the averages for San Joaquin and Tulare counties, respectively, were 6.29 per cent and 5.28 per cent. Incidence of defects for the all-variety class was higher in Tulare than in Fresno County. The Stanislaus County season average rose sharply after mid-October. The San Joaquin County average appears to be high largely because records were not obtained in the early part of the season and late-season deliveries showed very heavy defects. In the short periods over which records

were obtained, the Merced County and Madera County patterns of defects appeared similar to that of Fresno County. For all the counties, there was a pronounced upward drift in the impact of defects as the season progressed. With few exceptions, most of the differences in season averages are associated with differences in patterns of incidence after about the second week of October.

There were also large differences in the averages for particular points of origin. For example, the season average for all grapes from Del Rey was 1.62 per cent; from Stockton, 8.84 per cent. The average for Keyes was 1.52 per cent and for Modesto was 5.11 per cent. With few exceptions, the major differences in the season averages among points of origin appear largely attributable to differences in impact of defects in the closing weeks of the 1950 season. Nonetheless, the differences in averages among the various classes indicate that there would have been significant differences in percentages of all varieties combined which would have been eliminated by any uniformly applied maximum allowance of the listed defects. In general, those areas concentrating in late-season wine grapes would have been most adversely affected. Those areas in which raisin varieties dominated would have been required to eliminate the least. The effects of a maximum tolerance would have been concentrated in the last weeks of the season, almost to the extent of imposing a closing date.

The same variation is shown by Table 2 to exist with respect to particular varieties from particular areas of origin. The season average percentage of defects for wine grapes was 10.40 per cent for Ivanhoe but only 1.52 per cent for Keyes; 6.39 per cent for Sanger; and .45 per cent for Del Rey. For table grapes, the season average was only .94 per cent in Selma but was 4.06 in Parlier and 4.0 in Livingston. For raisin grapes, the season average in Exeter was 3.12 per cent but only 1.23 per cent in Del Rey. Size of sample and relative volume of the several varieties partly explain such differences.

The following conclusions appear supported by the 1950 data. For several reasons, the overseason averages of defects for all grapes, for varietal classes, and particular varieties differ sharply. There are also large differences among areas of origin. Any maximum tolerance for defects would, therefore, be likely to result in significantly large differences in percentages of elimination among the classifications considered here.

Intraseasonal Changes in Defects.--Analysis of the intraseasonal changes in the incidence of defects is made difficult by failure to obtain data from particular areas of origin and varietal classes continuously throughout the season. Variability of the available observations makes dangerous either interpolation or extrapolation for the missing data. The calculated trends shown in Figure 4 must, therefore, be taken as no more than rough indicators of the general drift within the season of the impact of defects upon the several varieties and varietal classes. However, available data are sufficient to indicate quite clearly the basic patterns of defects and further to indicate the major determinants of such changes.

The intraseasonal pattern of changes in defects is summarized in Table 3. Weekly averages are calculated from aggregation of individual sample records. The recorded defects of the individual varieties are then aggregated to obtain weighted weekly averages of defects by varietal classes. These averages are, in turn, aggregated to obtain weighted averages for all the varieties combined. Averages are recorded separately by district, county, and town from which the loads originated. The first week for which averages were computed ended on August 27, 1950; the twelfth and last week ended on November 12.

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The following conclusions appear supported by the 1950 data. For several reasons, the over-season averages of defects for all grapes, for varietal classes, and particular varieties differ sharply. There are also large differences among areas of origin. Any maximum tolerance for defects would, therefore, be likely to result in significantly large differences in percentages of elimination among the classifications considered here.

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TABLE 3

Weekly Averages of Percentages of Defective Grapes, All Varieties Combined, Varietal Classes and Varieties, by Areas of Origin

District, county, and town	Week ending: August 27			September 3					
	All raisin	Thompson	Sultana	All	Alicante	Malaga	All raisin	Thompson	Sultana
Central Valley	3.32	3.21	4.26	2.61	1.77	1.59	2.64	2.62	4.79
Fresno County	3.32	3.21	4.26	2.63	1.77	1.59	2.65	2.63	4.79
Caruthers				2.57			2.57	2.57	
Clovis				1.10			1.10	1.10	
Rel Rey	.87	.87		1.29			1.29	1.29	
Fowler	5.27	5.27		2.02			2.02	2.02	
Fresno	3.65	3.54	4.66	2.30		1.59	2.33	2.24	4.79
Kingsburg				2.57			2.57	2.57	
Parlier	3.93	3.93		4.66			4.66	4.66	
Reedley				4.26			4.26	4.26	
Sanger	1.46	1.46		3.35			3.35	3.35	
Selma	3.42		3.42	2.14	1.77		2.21	2.21	
Tulare County									
Dinuba									
Exeter									
Ivanhoe									
Madera County				1.14			1.14	1.14	
Madera				1.14			1.14	1.14	
Kings County									
Hanford									
San Joaquin County									
Escalon									
Lodi									
Stockton									
Stanislaus County									
Ceres									
Keyes									
Modesto									
Turlock									
Merced County									
Atwater									
Livingston									

(Continued on next page.)

Table 3 continued.

District, county and town	Week ending September 10									
	All	All wine	Alicante	Carignane	Feher Szago	Palomino	Malaga	All raisin	Thompson	Sultana
Central Valley	2.15	1.56	1.61	2.81	1.33	.58	1.61	2.18	2.15	3.05
Fresno County	2.14	1.56	1.61	2.81	1.33	.58	1.61	2.17	2.14	3.05
Caruthers	2.93							2.93	2.93	
Clovis	3.52							3.52	3.52	
Del Rey	1.50							1.50	.98	2.65
Fowler	2.81	2.81		2.81						
Fresno	1.92	1.11	1.61					1.98	1.89	3.24
Kingsburg	2.27							2.27	2.27	
Parlier	2.04	1.33			1.33			2.21	2.21	
Reedley	1.30							1.30	1.30	
Sanger	2.02							2.02	2.02	
Selma	2.23							2.23	2.23	
Tulare County	3.12							3.12	3.12	
Dinuba										
Exeter	3.12							3.12	3.12	
Ivanhoe										
Madera County	2.10							2.10	2.10	
Madera	2.10							2.10	2.10	
Kings County										
Hanford										
San Joaquin County										
Escalon										
Lodi										
Stockton										
Stanislaus County										
Ceres										
Keyes										
Modesto										
Turlock										
Merced County										
Atwater										
Livingston										

(Continued on next page.)

Table 3 continued.

District, county and town	Week ending October 1 All	All wine	Alicante	Carignane	Grenache	Malvoisie	Zinfandel	All table	Malaga	Ribier	All raisin	Thompson	Muscat
Central Valley	2.74	2.36	1.11	2.27	2.21	2.42	5.31	3.76	4.70	1.18	2.75	1.59	2.98
Fresno County	2.81	2.48	1.11	2.60	2.21	2.42	5.31	3.76	4.70	1.18	2.81	1.59	3.08
Caruthers													
Clovis	2.81							2.81	2.81				
Del Rey	.45	.45	.45										
Fowler	3.33										3.33		3.33
Fresno	3.18	3.17				2.42	5.31	3.10	5.29	1.18	3.20	1.90	3.79
Kingsburg	2.37	2.42	1.74	2.60							2.34	1.15	2.46
Parlier	2.70	2.98			2.98						2.65	1.23	2.85
Reedley													
Sanger	2.89	1.44			1.44			6.07	6.07		1.96	1.59	2.34
Selma	2.92										2.92	1.33	3.23
Tulare County													
Dinuba													
Exeter													
Ivanhoe													
Madera County	1.99										1.99		1.99
Madera	1.99										1.99		1.99
Kings County	2.50										2.50		2.50
Hanford	2.50										2.50		2.50
San Joaquin County													
Escalon													
Lodi													
Stockton													
Stanislaus County	1.60	1.60		1.60									
Ceres													
Keyes													
Modesto	1.60	1.60		1.60									
Turlock													
Merced County													
Atwater													
Livingston													

(Continued on next page.)

Table 3 continued.

District, county and town	Week ending October 22														
	All	wine	Alicante	Carignane	Grenache	Mission	Palomino	Mixed wine	All table	Emperor	Malaga	Ribier	Tokay	Mixed table	Muscat
Central Valley	3.70	4.69	3.88	5.82	2.59	1.77	4.26	5.37	2.33	.84	2.48	2.32	1.43	3.54	3.22
Fresno County	3.34	4.80	3.17	6.77		1.92		5.97	2.35	.84	2.48	1.33			3.22
Caruthers															
Clovis															
Del Rey	3.08										3.08				
Fowler															
Fresno	3.76	5.64		8.07		1.42		7.00	1.88	.84	2.42	1.33			3.12
Kingsburg	2.74	2.95	3.17	2.88		2.26		4.92	2.61		2.61				
Parlier	3.19														3.19
Reedley															
Sanger	6.95	8.64		8.63											3.60
Selma	.94								.94		.94				
Tulare County															
Dinuba															
Exeter															
Ivanhoe															
Madera County															
Madera															
Kings County															
Hanford															
San Joaquin Co.	1.43								1.43				1.43		
Escalon															
Lodi	1.42								1.42				1.42		
Stockton	1.43								1.43				1.43		
Stanislaus County	4.61	4.65	4.59	5.44	2.59	1.41	4.26		3.54					3.54	
Ceres	3.33	3.33		3.33											
Keyes	1.52	1.51				1.52									
Modesto	4.92	4.99	4.59	5.85	2.59	1.31	4.26		3.54					3.54	
Turlock															
Merced County	3.72	4.13					4.13		3.31			3.31			
Atwater															
Livingston	3.72	4.13					4.13		3.31			3.31			

(Continued on next page.)

Table 3 continued.

District, county, and town	Week ending[a/]											
	November 5											
	All	All wine	Carignane	Grenache	Palomino	Mixed wine	All table	Culls	Emperor	Malaga	Ribier	Mixed table
Central Valley	3.67	8.23	7.84	7.52	6.84	10.02	2.37	1.79	1.69	2.95	3.65	2.24
Fresno County	2.77	6.70		6.67	6.84		2.32	1.63	1.71	3.10		2.24
Caruthers												
Clovis	1.27						1.27		1.27			
Del Rey	2.57						2.57			2.57		
Fowler	6.67	6.67		6.67								
Fresno	2.83						2.83	2.30	1.84	3.13		
Kingsburg												
Parlier	4.27											
Reedley	3.31						3.31		3.31			
Sanger	2.20	6.84			6.84		1.86	1.01	1.70	3.40		2.24
Selma												
Tulare County	5.95	10.40	3.56			17.14	1.75	2.11	1.41			
Dinuba												
Exeter	1.75						1.75	2.11	1.41			
Ivanhoe	10.40	10.40	3.56			17.14						
Madera County												
Madera												
Kings County												
Hanford												
San Joaquin County	9.40	9.40		9.21		9.58						
Escalon												
Lodi												
Stockton	9.40	9.40	9.23	9.21		9.58						
Stanislaus County	5.25	7.88				3.79	3.33			1.63	5.00	
Ceres												
Keyes	6.31	7.88	9.23			3.79						
Modesto	8.79	8.79	11.28									
Turlock	3.90	5.11	5.11				3.33			1.63	5.00	
Merced County	2.65						2.65			2.76	2.24	
Atwater	2.84						2.84			2.84		
Livingston	2.39						2.39			2.54	2.24	

(Continued on next page.)

Table 3 continued.

District, county and town	Week ending[a] November 12 All	All wine	Carignane	Mixed wine	All table	Culls	Emperor	Malaga
Central Valley	5.36	19.42	22.50	17.90	3.90	4.35	3.33	7.14
Fresno County	4.69	18.56	22.50	14.62	3.58	4.05	3.27	6.35
Caruthers								
Clovis	2.30				2.30		2.30	
Del Rey								
Fowler								
Fresno	5.92	18.56	22.50	14.62	3.70	3.75	2.72	6.35
Kingsburg								
Parlier	3.95				3.95		3.95	
Reedley	3.97				3.97		3.97	
Sanger	3.25				3.25	6.16	2.02	
Selma								
Tulare County	5.08				5.08			
Dinuba	4.17				4.17		4.17	
Exeter	5.52				5.52	5.52		
Ivanhoe								
Madera County								
Madera								
Kings County								
Hanford								
San Joaquin County	21.08	21.08		21.08				
Escalon								
Lodi								
Stockton	21.08	21.08		21.08				
Stanislaus County								
Ceres								
Keyes								
Modesto								
Turlock								
Merced County	7.90			7.90				7.90
Atwater								
Livingston	7.90			7.90				7.90

a/ Observations for Cornichon and Almeria varieties are not shown in the table.

The weekly averages for the varietal classes and major varieties are plotted against the week of the season in Figure 4. These averages are relevant to the Central Valley only. For some varieties, weekly averages could be computed only for a few consecutive weeks. Weekly averages were not computed for the weeks ending September 17 and 24 and October 8, 15, and 29. The time series shown in Figure 4 is thus based on discontinuous data.9/

In Panel A, the weekly averages for varietal classes and for all varietal classes combined are shown. The line marked "1" indicates the general drift of the average incidence of defects from week to week for all varieties from all areas combined. There was a rise in the incidence of defects from about an average of 2.5 per cent at the beginning of the season to about 4.4 per cent at the ending. This general average weekly rate of change in defects is roughly indicated by the line marked "5" which is a linear trend fitted to the weekly averages by least squares. Line "2" is the weekly averages for all wine grapes from all the Central Valley areas. In general, the incidence of defects was lower for wine grapes than for other varietal classes early in the season. However, impact of defects increased at a faster rate and by mid-October was above the weighted weekly averages for varietal classes. Thereafter, defects increased sharply to an average of 19.42 per cent in the last week of the season. Line "3" represents the weekly averages for all table grapes from all points of origin. Incidence of defects was lower than for other classes except in the opening month of the season. The weekly rate of increase was about .136 per cent. Weekly averages are shown for the raisin varieties in line "4." Data were obtained for only nine weeks. There was an apparent decrease in incidence of defects in the first three weeks and an apparent slow rise thereafter. The average weekly rate of increase was about .058 per cent. Panel A thus indicates that neither raisin nor table grapes reached high levels of defects in 1950. The wine grape class showed far heavier affliction with the listed defects and a far faster rate of increase as the season progressed.

In Panel B, the weekly averages for the major wine grape varieties are shown. Line "1" is the weekly averages for all varieties of wine grapes from all Central Valley areas of origin included in the sample. It is the same as line "2" in Panel A. Line "8" is a fitted linear trend to the all-wine-varieties series, although the observations indicate that a curvilinear function would provide a better fit. Carignane grapes, shown by line "2," were generally higher in defects than others. Alicantes, shown by line "6," were generally low in defects compared to other wine varieties. The most striking aspect of Panel B is the fact that, after mid-October, nearly all wine varieties show increasing rates of incidence of defects, reaching extremely high levels by the end of the season.10/

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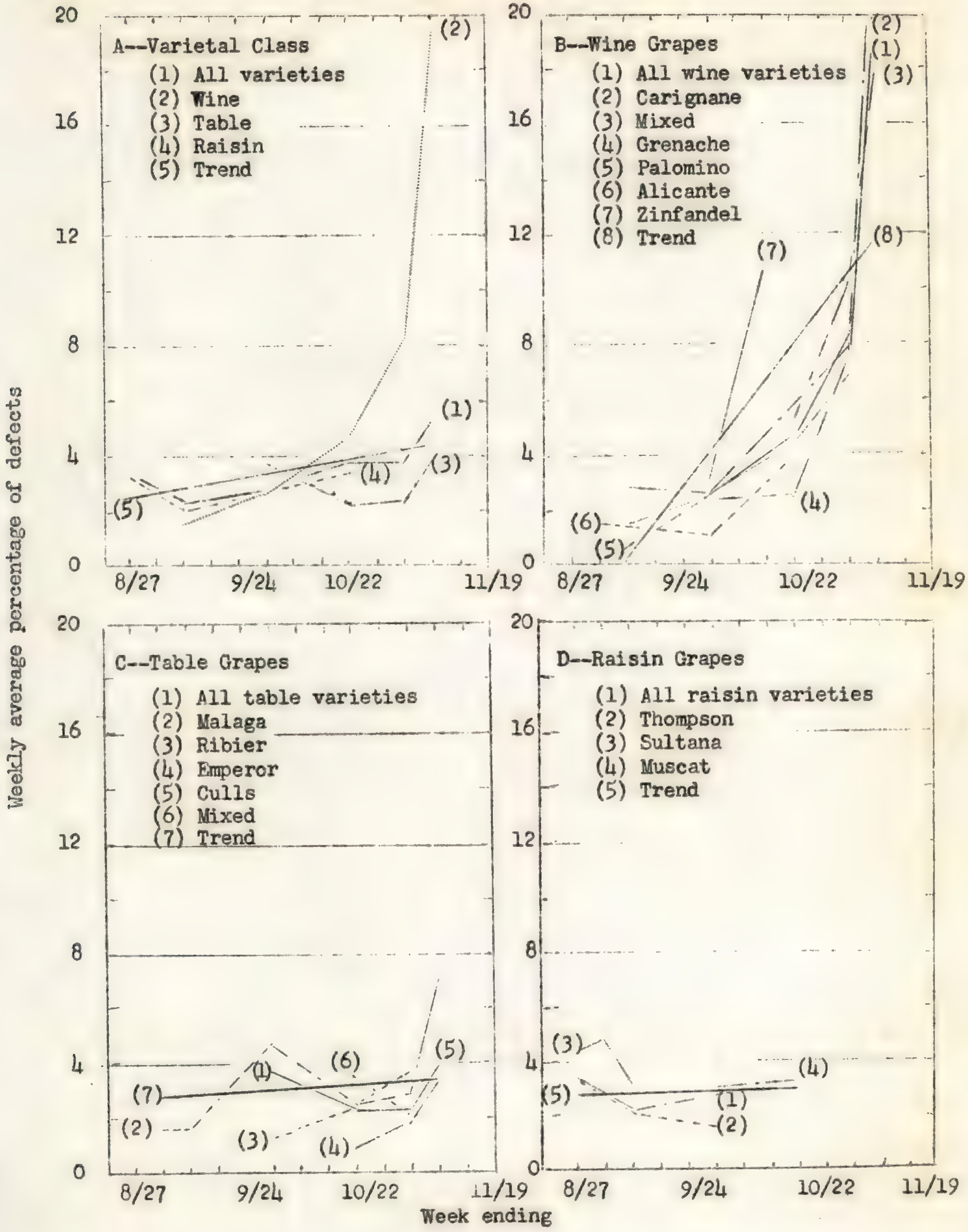
9/ The charts in Figure 4 are based on the following numbers of samples: all wine varieties, 85 loads; Carignanes, 40; Alicantes, 10; all table varieties, 112; Malagas, 45; Emperors, 39; all raisin varieties, 253; and Thompsons, 195.

10/ Wine variety trends could probably be better approximated by logarithmic functions. However, the analysis is restricted to one year and to discontinuous data. Results must, therefore, be taken as no more than preliminary indications of general relationships in 1950. The trend for wine varieties is greatly affected by the observations of the last week. However, even without this last observation, the intraseasonal rate of increase was far sharper for wine varieties than for others.

FIGURE 4

Weekly Average Percentages of Defects, by Varietal Class and Variety, Central Valley, 1950



Intraseasonal changes in the table varieties are shown in Panel C. Line "1" is the all-table-varieties series identical with line "3" in Panel A. Line "7" is the calculated least squares linear trend, indicating a low rate of increase on the average from week to week. Emperor grapes were generally least affected by defects. Malagas were generally the most affected by defects throughout the season. None of these varieties showed the pattern of rapid late-season increase typical of the wine varieties.

The same data for raisin varieties are shown in Panel D. Thompsons showed a consistent decrease in defects through the season, although no data were obtained after October 1. The short periods for each variety make comparison of them difficult. There was practically no intraseasonal trend in defects for the raisin varieties as a whole.

The intraseasonal averages for all varieties combined are shown by counties in Panel A of Figure 5. Data are fragmentary for some of the county subclassifications, but several tentative generalizations may be drawn. The heavy weight of Fresno County in the total sample results in a time series for that County very similar to that for the whole Valley. Tulare County appears to have had generally higher levels of defects than Fresno. The two northern counties of Stanislaus and San Joaquin appear to have suffered more heavily in the closing weeks of the season than did the southern valley counties. The high level shown for San Joaquin County is due in part to the fewness of observations.

Data are insufficient to develop continuous time series for defects in wine grapes by counties except for Fresno County which is shown in Panel B of Figure 5. Observations from other counties for particular weeks are shown by numbered dots. The little evidence which is available indicates that there appeared to be little difference among areas in the intraseasonal patterns of incidence of defects among wine grapes.

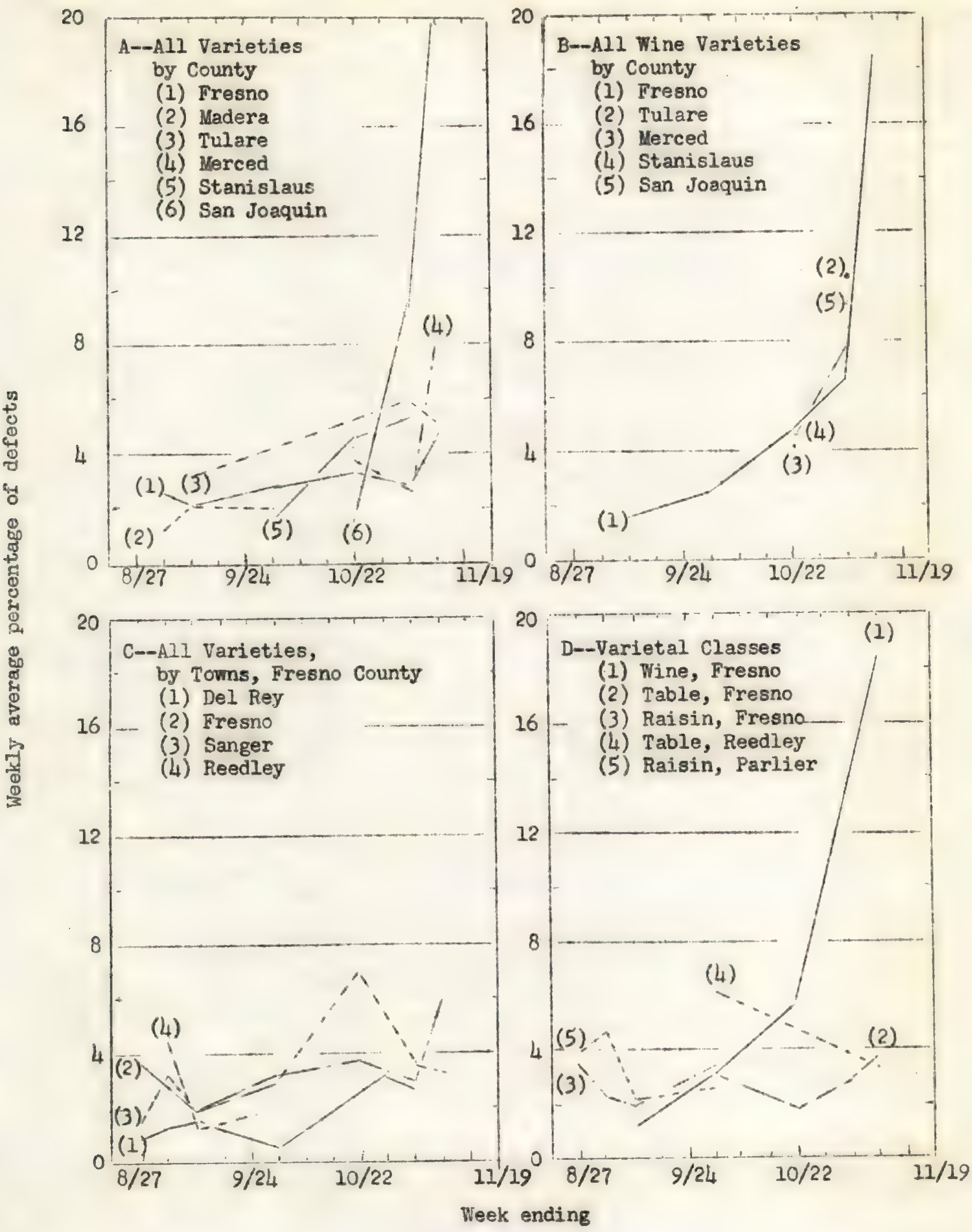
In Panel C are shown the weekly weighted averages of defects for all varieties combined originating from each of four towns in Fresno County. There are individual observations which deviate sharply from the general drift of the county as a whole. But it is doubtful that the available data indicate significant differences in the incidence of defects in given types of grapes from different areas. In Panel D are shown weekly weighted averages for varietal classes of grapes from particular areas of origin in Fresno County. Again, it appears that varietal differences are more important sources of variation than differences in areas of origin.

In summary, major differences in defects are indicated in Figures 4 and 5. Wine varieties in 1950 had the highest level of defects and increased in incidence of defects most rapidly. Table grapes were much lower in defects on the average than wine grapes and showed less rapid rates of increase in the late weeks of the season. Raisin grapes had the lowest incidence of all classes. The proposed control would, therefore, hit hardest against wine grapes and particularly against those which were harvested late in the season. Available data indicate that differences in relative volume of individual varieties are the most important determinant of differences in incidence of defects among areas.

Intraseasonal Changes in Types of Defects by Varietal Classes.--Six different defects were estimated in calculating the total percentage of defective grapes by varieties and by varietal classes and the averages and confidence intervals for the season as a whole.

FIGURE 5

Weekly Average Percentages of Defects, Varietal Classes, by Areas of Origin, Central Valley, 1950



The weighted average percentage of the defects for each week attributable to each one of the six deficiencies is indicated in Panel A of Figure 6 for the combined samples of wine grapes. Numbers on the bars for each week have the following meanings: (1) waterberry or redberry; (2) decay, rot, or mold; (3) heat or sun damage; (4) raisined or raisining berries; (5) freeze or rain damage; and (6) measles or mildew. Percentage of defects is shown on the vertical axis. Each block of bars represents the aggregate defects by types reported for the indicated week. The sum of the percentages of the bars in each block will always be 100. Thus, the charts do not show total incidence of the various defects but rather the percentage of all defects in each week attributable to each one of the six kinds of defects.

For wine grapes, the major source of defects in the early part of the season was waterberry or redberry. Decay, rot, or mold were major sources of defects in early October and again in late October and early November. Heat and sun damage represented a fairly stable part of the damage to wine grapes in the first six weeks. The relative impact of raisined or raisining berries shifted through the season. Freeze or rain damage was not reported until the last two weeks of the season during which they accounted for about one-fifth of the total weekly defects.

Constituency of defects for table grapes is indicated in Panel B of Figure 6 which is set up to parallel Panel A explained above. Defects in wine grapes were largely waterberry in the first weeks with decay, rot, and mold the major sources of defects in subsequent weeks. In table grapes, the sources of defects appeared entirely different. In the first week shown, more than 85 per cent of the defective berries were damaged by heat or sun with the remainder attributable to rot or mold. In the second week, all reported defects were due to heat or sun damage. In the week ending October 1, measles or mildew accounted for two-thirds of the damage. Nearly all sources of damage were reported in the last three weeks, although heat or sun damage was dominant in each of the three weeks. Thus, trends of varietal classes and of particular varieties differed in 1950. The relative importance of particular defects differed significantly among varietal groupings. The time sequences of appearance of particular defects differed among varietal classes. The causes of these differences in aggregate incidence of defects also differed.

Constituency of defects among all varieties of raisin grapes also showed characteristics unique to this group. The dominant cause of defects among the loads sampled was discoloration from heat or sunburn. Measles or mildew were major causes of defects in the early weeks. Raisined or raisining berries were important defects among the raisin varieties in the first two weeks of the season. The composition of defects in raisin varieties was more similar to the table grapes than to wine varieties. However, the magnitude of defects, the apparent trends within the season, and the causes of the total defects differed significantly among all three groups. Relative importance of the various defects is indicated in Panel C of Figure 6.

The percentage composition of weekly defects is shown for Carignanes, Alicantes, Malagas, Emperors, Thompsons, and Sultanas in Panels D through H of Figure 6. Waterberry was important as a source of defects in Carignanes in the early weeks. Decay, rot, or mold were leading causes of defects in all weeks. Heat or sun damage declined as a percentage of total weekly defects after the second week. Raisining did not appear until the week ending October 8 but was reported in all subsequent weeks. Rain damage appeared after November 1. There were no reports of measles or mildew in any of the six weeks reported.

[illegible]

For wine grapes, the major sources of defects in the early part of the season was waterberry or redberry. Decay, rot, or mold were major sources of defects in early October and again in late October and early November. Heat and sun damage represented a fairly stable part of the damage to wine grapes in the first six weeks. The relative impact of raisined or raisining berries shifted through the season. Measles or rain damage was not reported until the last two weeks of the season during which they accounted for about one-fifth of the total weekly defects.

Constituency of defects for table grapes is indicated in Panel B of Figure [illegible] which is set up in the same way as Panel A explained above. Defects in wine grapes were largely waterberry in the first weeks with decay, rot, and mold the major sources of defects in subsequent weeks. In table grapes, the sources of defects appeared entirely different. In the first week shown, more than 85 per cent of the defective berries were damaged by heat or sun with the remainder attributable to rot or mold. In the second week, all reported defects were due to heat or sun damage. In the week ending October 1, measles or mildew accounted for two-thirds of the damage. Nearly all sources of damage were reported in the last three weeks, although heat or sun damage was dominant in each of the three weeks. Thus, trends of varietal classes and of particular varieties differed in 1950. The [illegible] percentage. The time sequence of appearance of particular defects differed among varietal classes. The causes of these differences in aggregate incidence of defects also differed.

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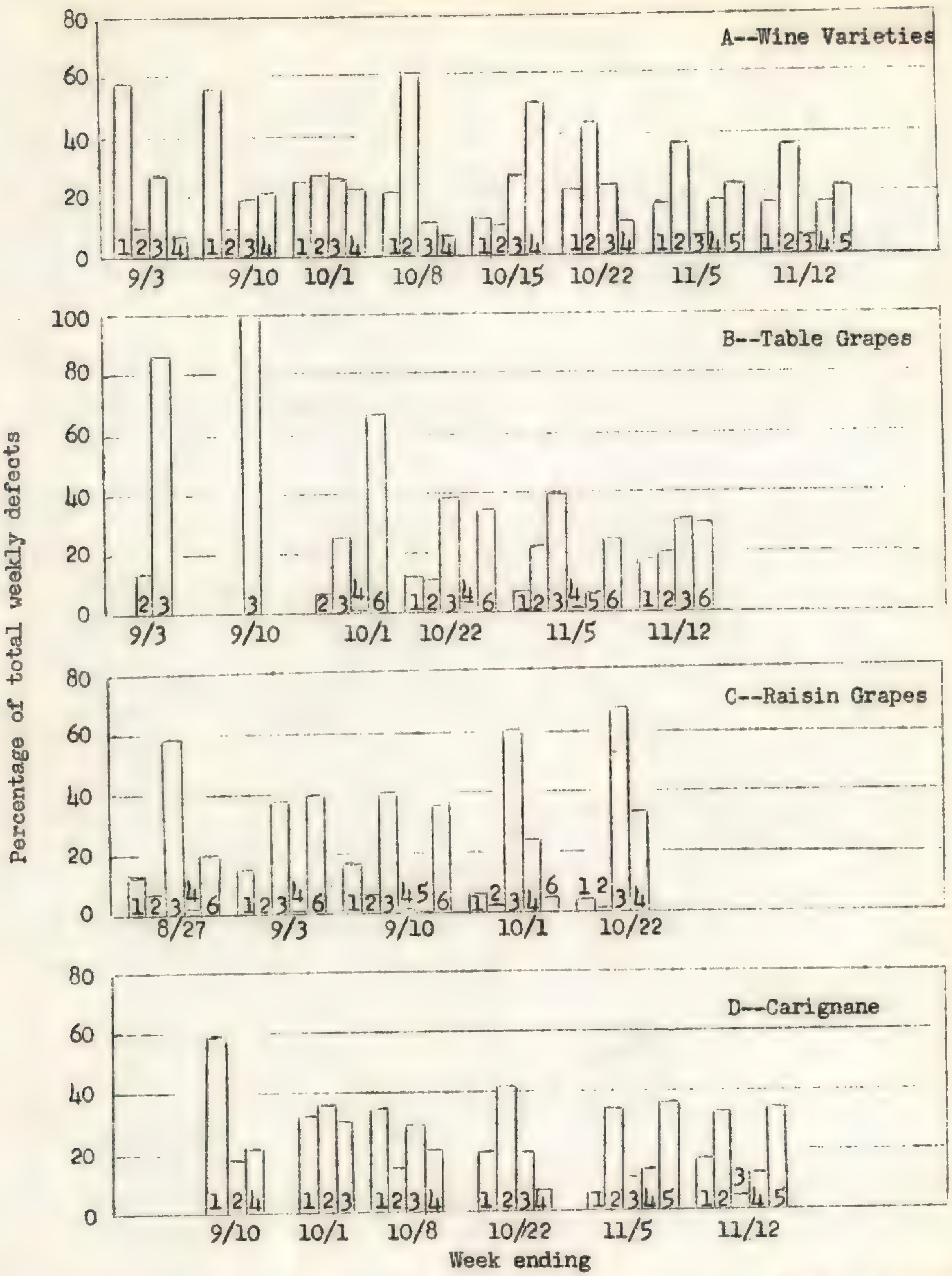
FIGURE 6a

Percentage of Each Type of Defect in Total Defective Tonnage, by Weeks, Central Valley, 1950



1: Waterberry or redberry. 2: Decay, rot, or mold. 3: Heat or sun damage.
4: Raisined or raisining. 5: Freeze or rain. 6: Measles or mildew.

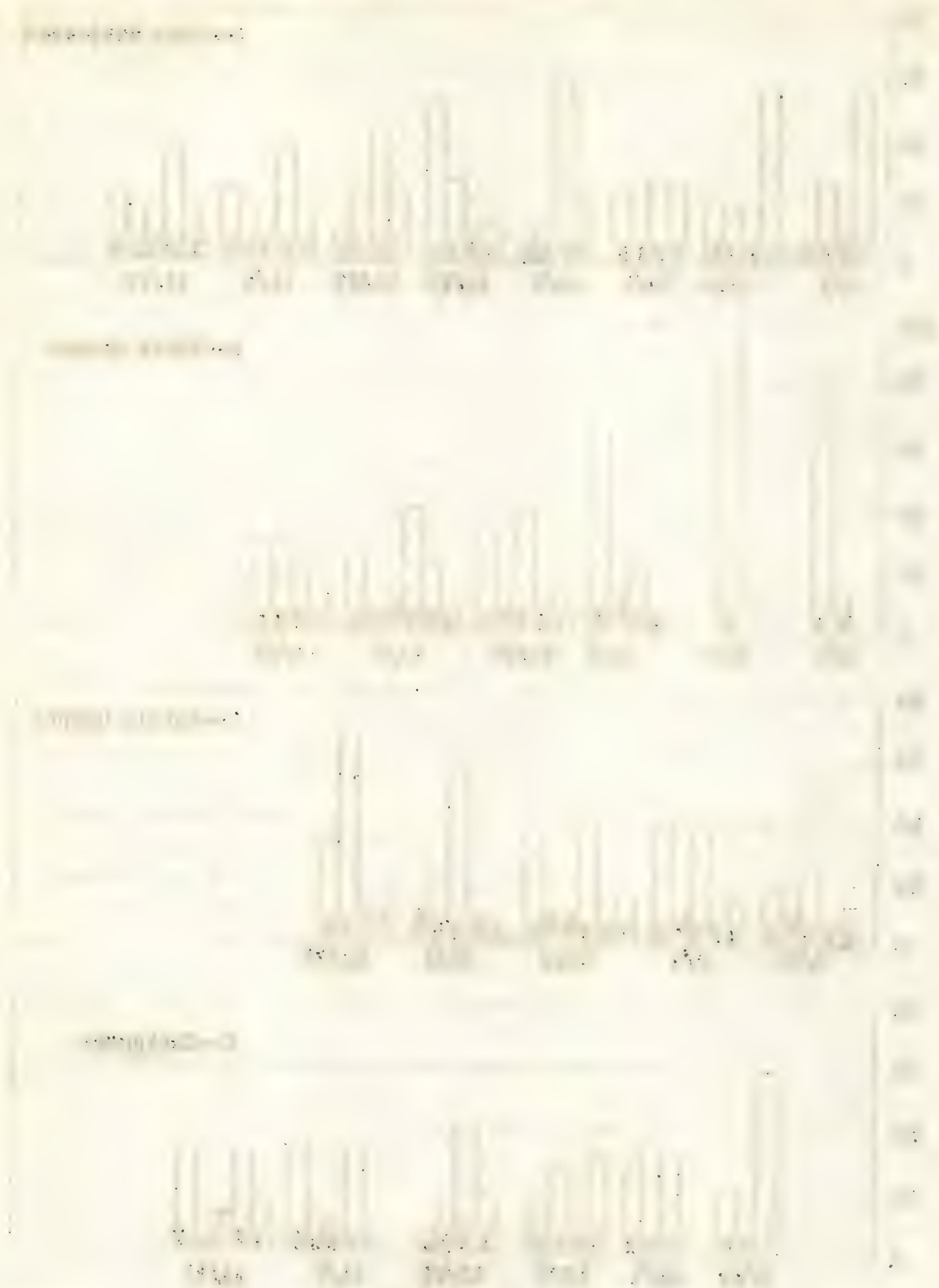
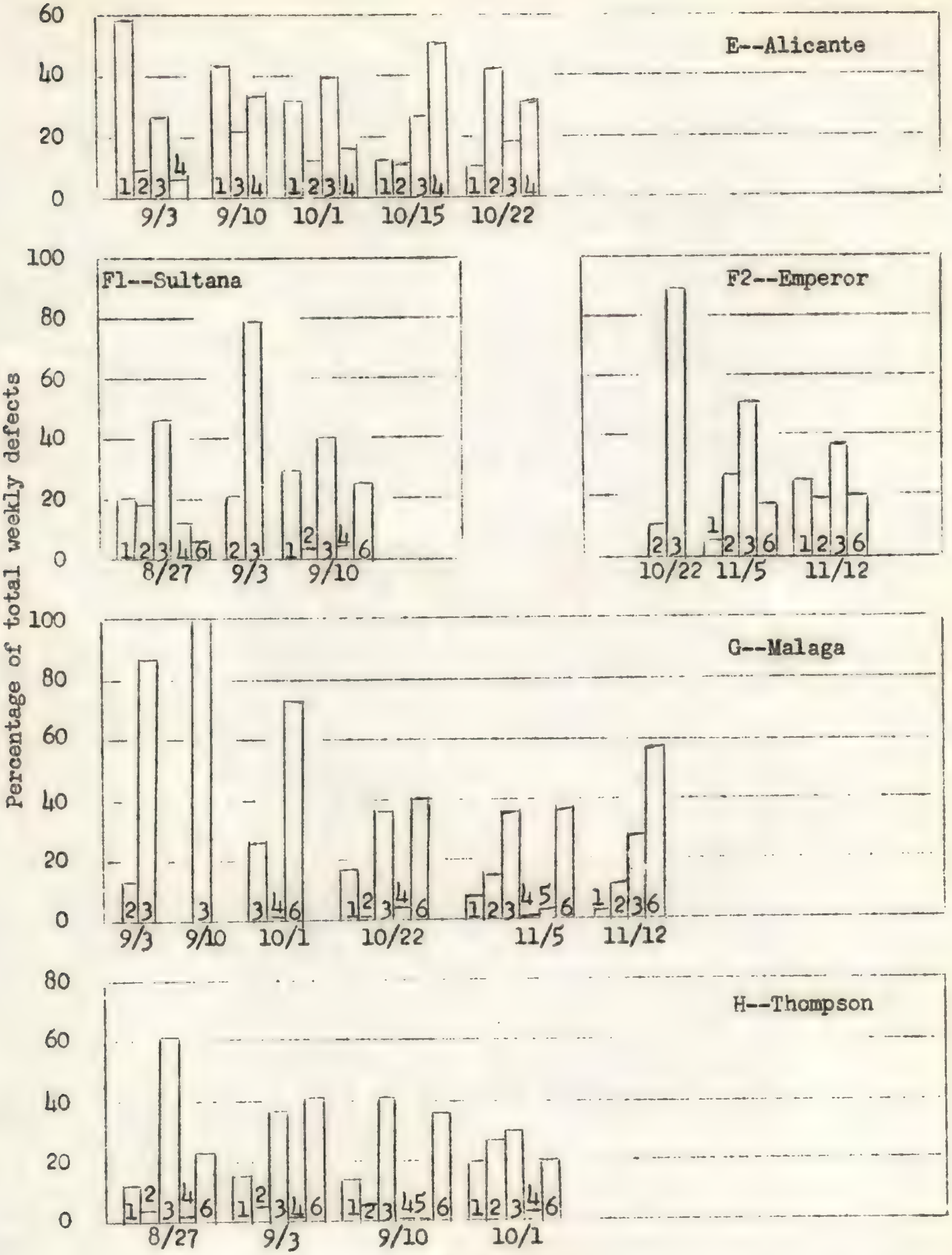
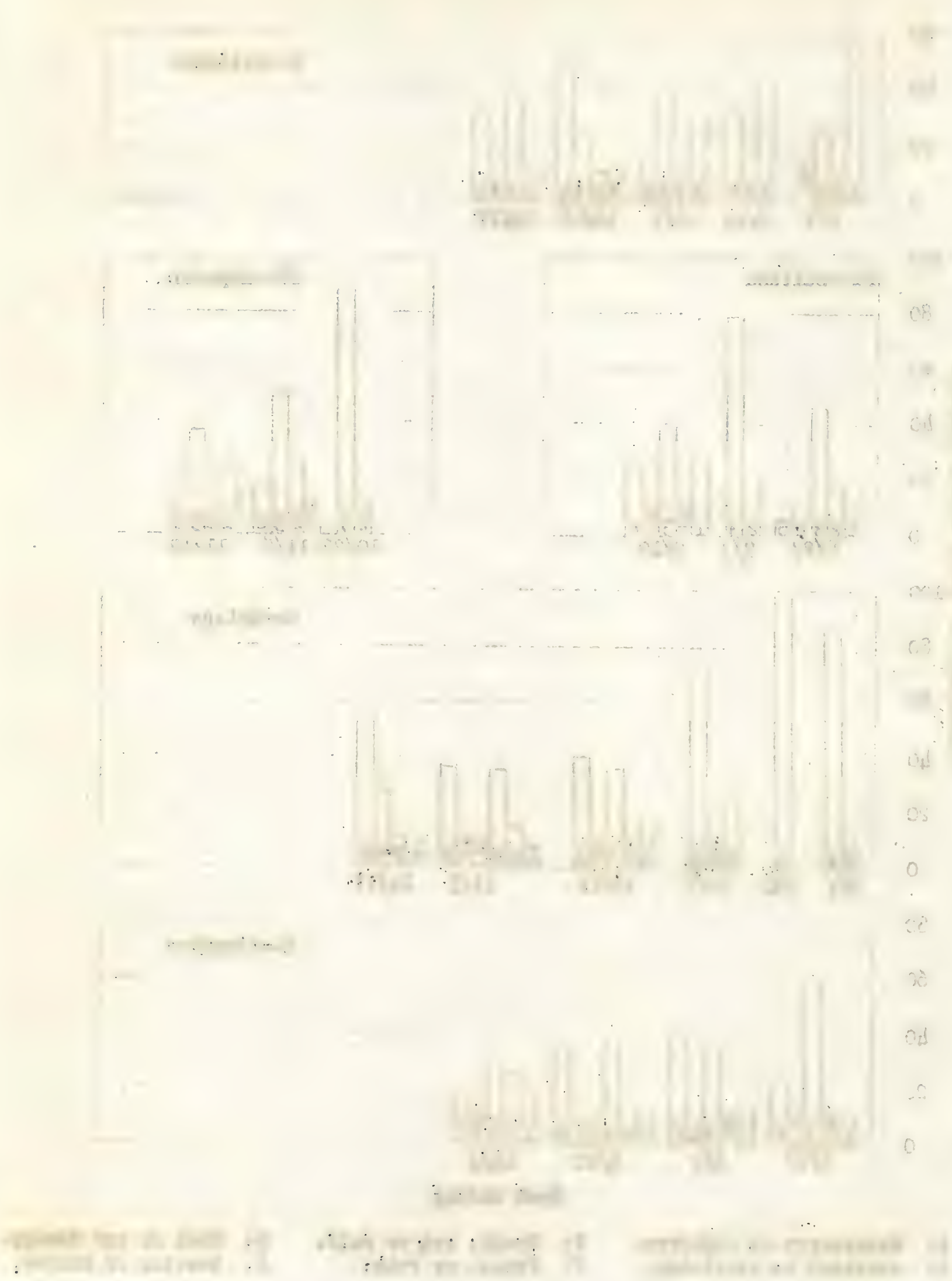


FIGURE 6b



Week ending

1: Waterberry or redberry. 2: Decay, rot, or mold. 3: Heat or sun damage.
4: Raisined or raisining. 5: Freeze or rain. 6: Measles or mildew.



The pattern of defects in Alicantes was much similar to that of Carignanes until about mid-October. Raisined or raisining berries appeared to cause relatively more of the total defects in Alicantes than in Carignanes. Relatively more damage appeared to be caused by heat or sun than in Carignanes. No rain damage was reported for Alicantes. Again, unlike Carignanes, measles or mildew were listed as important determinants of defects after November 1.

Defects of Malagas were caused by still different patterns of particular defects at particular times of the season. Nearly all damage in the first month was charged to heat or sun discoloration. After October 1, nearly all defects were reported in the four subsequent samplings of this variety. Measles or mildew were the main causes in the last six weeks of the season.

Discoloration from heat or sunburn appeared as an important cause of defects throughout the season for Sultanas. Measles or mildew accounted for from one-fifth to two-fifths of the defects in the remainder of the season. Decay was reported in the first and last parts of the season.

At least in 1950 there was little stability either among varietal classes or varieties in the relative incidence of specific defects at various times within the season.

Tonnage Eliminated

A 3-per cent maximum allowance for all defects, applied to all varieties at all parts of the season, would have eliminated the following percentages of the loads tested in the Central Valley in 1950: all varieties, 36.23; wine varieties, 60; table varieties, 37.50; and raisin varieties, 27.67. Thus, raisin varieties, for which level of defects tended to decrease in the season, would have been least affected by a 3-per cent maximum allowance for the defects believed by the industry to be associated with quality of wine.

If the maximum were raised to 4 per cent, the following percentages of the loads tested would have been denied access to the winery: all varieties, 21.78; wine varieties, 47.06; table varieties, 19.64; and raisin varieties, 14.23. A 5-per cent maximum would have dropped the elimination percentage for all varieties to 14.45; for wine grapes to 38.82; table varieties to 12.50; and raisin varieties, 7.11. These results are summarized in Table 4.

A 3-per cent maximum allowance for the listed six groups of defects would have resulted in elimination of 71.43 per cent of the loads of Malagas and 77.50 per cent of the loads of Carignanes. The same maximum would have eliminated only 23 per cent of both Thompsons and Emperors. A 4-per cent maximum would have lowered the elimination percentages to 10 and 13 for Emperors and Thompsons, respectively. More than 60 per cent of the Carignanes would have been eliminated. A 5-per cent tolerance would have dropped the Emperor percentage to 5 per cent and that for Thompsons to 7.3 per cent.

In general, the proposed defect allowance would have kept wine grapes out of the wineries. Emperors would have been least affected and Thompsons would similarly have been relieved of any significant part of the burden of elimination. The industry should consider two issues: whether these are the kinds of grapes in which elimination should be concentrated; whether these significant differences in elimination percentages would preclude effective administration of control of volume.

TABLE 4

Estimated Percentage of Deliveries Eliminated by Maximum Allowances for Listed Defects, by Varieties, Central Valley, 1950

Variety	Percentage eliminated by maximum allowance		
	3-per cent defects maximum	4-per cent defects maximum	5-per cent defects maximum
All varieties	36.23	21.78	14.45
Wine varieties	60.00	47.06	38.82
Alicante	30.00	10.00	0
Carignane	77.50	62.50	50.00
Table varieties	37.50	19.64	12.50
Emperor	23.08	10.26	5.13
Malaga	42.22	17.78	8.89
Raisin varieties	27.67	14.23	7.11
Thompson	23.44	13.02	7.29
Sultana	71.43	28.57	14.29

The seasonal elimination associated with alternative levels of the maximum tolerance for defects is shown in Figure 7 for all varieties, raisin varieties, wine varieties, table varieties, Carignanes--the highest defect variety in the sample--and Emperors--the lowest defect variety in the sample.

An alternative proposal would close off crushing when the average defects of all varieties combined reached the specified maximum allowance. At that time crushing would be denied to all grapes. Prior to that time, some grapes with higher rates of defects than the maximum would have been eligible. These data are shown for 1950 in column 1 of Table 5. Thus, in 1950 the proposal would have allowed the crushing of 67.35 per cent of all the grapes which averaged more than 4 per cent defects. This is equivalent to saying that two-thirds of all the loads averaging over 4 per cent of defects were harvested before the average for all varieties reached that level. After the closing date, there would be grapes with less than 4 per cent defects which would nonetheless be ineligible. These data are shown in column 4 of Table 5. Thus, 18.47 per cent of the grapes which had less than 4 per cent defects would nonetheless have been ineligible for crushing. The impact would have been heaviest on table grapes. For all combined, 70 per cent of the loads which qualified under the general defects maximum of 4 per cent would have been denied access to the wineries. For Emperors, 97 per cent of the loads with less than 4 per cent defects would still have been ineligible with 46 per cent of the Malagas similarly affected.

About 21.5 per cent of the loads sampled would have been ineligible under this program. About the same percentage of wine grapes would have been ineligible. No raisin grapes would have been eliminated. The impact would have been by far hardest on such varieties as Emperors. In 1950, Emperors were, of course, harvested late. But they were much less afflicted with defects than were late-harvested wine grapes. Thus, nearly 100 per cent of these grapes actually qualified

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TABLE 5

Estimated Percentage of Deliveries, by Varietal Class and Variety, Eliminated by Closing the 1950 Season at the End of the Tenth Week When the Average Incidence of Defects Reached a Hypothetical Maximum Allowance of 4 Per Cent

Varieties	Prior to tenth week eligible		After tenth week ineligible		Per cent of total production eliminated
	More than 4 per cent	Less than 4 per cent	More than 4 per cent	Less than 4 per cent	
	1	2	3	4	5
All varieties	67.35[a/]	81.53[b/]	32.65[c/]	18.47[d/]	21.55
Wine varieties	60.00	95.56	40.00	4.44	21.17
Alicante	100.00	100.00	0	0	0
Carignane	80.00	86.67	20.00	13.33	17.50
Table varieties	27.27	30.00	72.73	70.00	70.54
Emperor	0	2.86	100.00	97.14	97.44
Malaga	50.00	54.05	50.00	45.95	46.67
Raisin varieties	100.00	100.00	0	0	0
Sultana	100.00	100.00	0	0	0
Thompson	100.00	100.00	0	0	0

a/ Percentage of all loads received in season averaging more than 4 per cent defects but eligible for crushing because received prior to tenth week.

b/ Percentage of all loads received in season averaging less than 4 per cent defects eligible for crushing since received prior to tenth week.

c/ Percentage of loads averaging over 4 per cent defects and ineligible for crushing.

d/ Percentage of all loads received in season averaging less than 4 per cent defects but denied entry because received after closing date.

FIGURE 7

Cumulated Frequency of Percentages of Loads in Excess of Specified Percentages of Defects, Central Valley, 1950

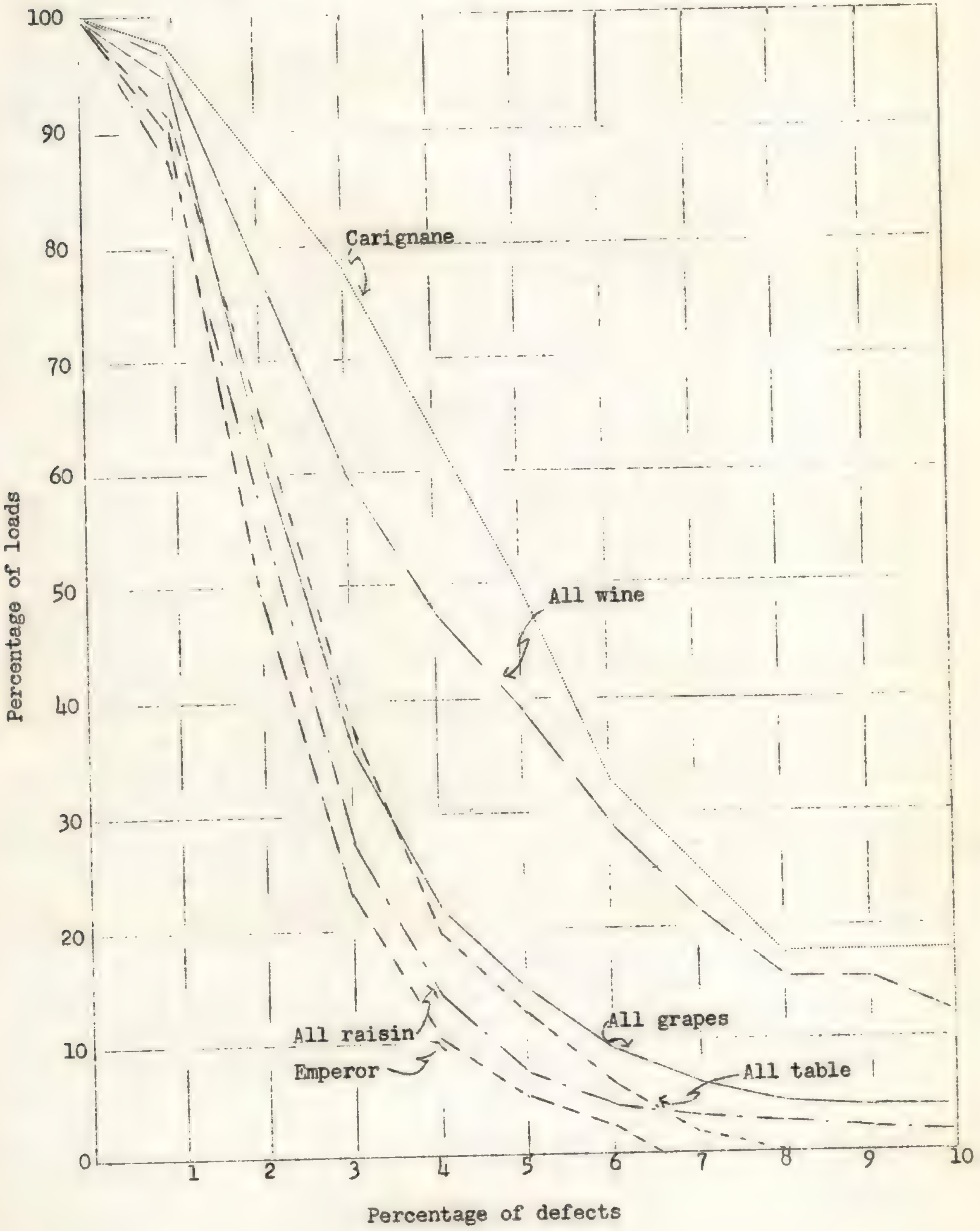
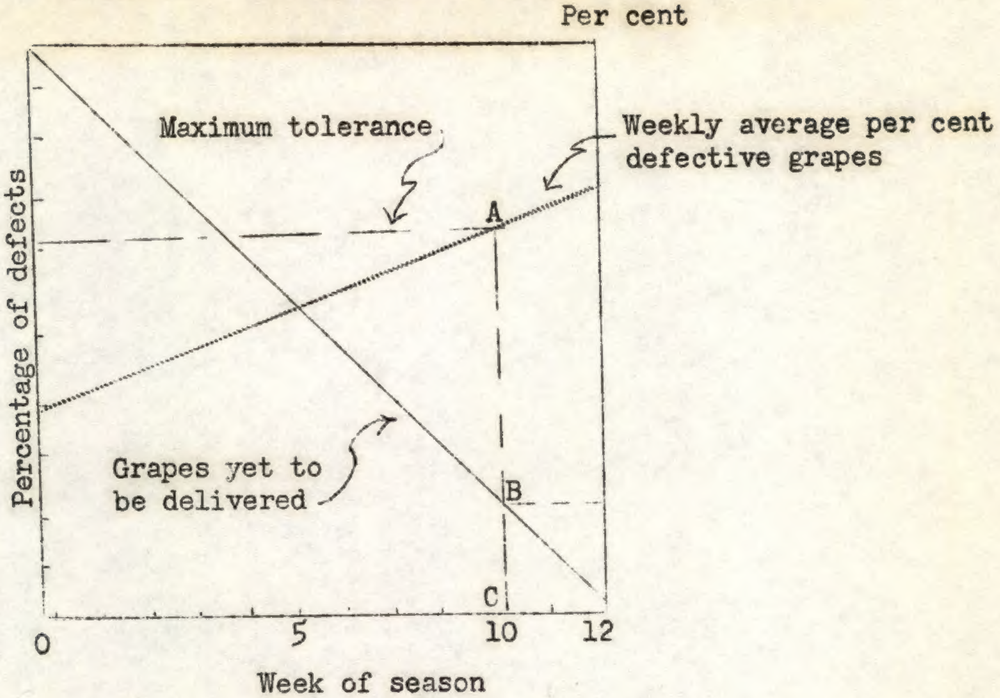


FIGURE 8

Alternative Quality Control Proposal



A: Intersection of tolerance limit and trend of defectiveness indicating closing date C.

B: Intersection of line AC and "volume to be delivered" indicating percentage of total tonnage eliminated from the crush.

by the quality standard would have been denied access solely because other varieties become increasingly afflicted with late season defects. On the other hand, 60 per cent of the loads of wine grapes which, in fact, had more than 4 per cent of defects, would have been eligible because such defects occurred early in the season.

It is doubtful that a closing date which would permit crushing of wine varieties with more than the specified maximum tolerance of defects while denying winery access to table grapes with less than the specified tolerance of defects can properly be called a quality control program. Closing dates would certainly be inequitable among areas and varieties. The combined quality-closing date proposal is no more than a closing date proposal with rather more inequity than would be associated with straightforward termination of crushing.

APPENDIX TABLE 1

Weekly Average Percentage of Defects, by Weight, North Coast District, by County, Town, by Varietal Class, and Variety, Weeks Ending October 8 and October 15, 1950

District, county, and town	Week ending													
	October 8							October 15						
	All wine	Alicante	Carignane	Golden Chasselas	Grenache	Zinfandel	Mixed	All wine	Alicante	Carignane	Golden Chasselas	Grenache	Zinfandel	Mixed
North Coast	2.38	2.42	1.77	2.44	3.93	1.99	2.66	2.81	3.74	1.95	1.82	1.31	3.16	2.82
Sonoma County	2.07	2.42	1.93	2.83		1.73	2.10	2.94	3.74	1.70	1.47		3.26	2.87
Asti	2.15	2.42	2.07			2.05	2.20	3.37	3.70				2.94	3.72
Cloverdale	.97		.68	1.82		.96	.80	1.61		1.70				1.45
Fulton								3.10					4.13	2.37
Geyserville	2.16					2.16		2.58	4.06	1.68			2.16	
Healdsburg	3.19			3.75			3.01	1.46			1.46			
Santa Rosa								1.80						1.80
Windsor								3.24			1.47			6.75
Mendocino	2.70		1.45	1.76		2.66	3.46	2.51		2.31	2.76		2.15	2.68
Boonville	10.28						10.28	3.01					3.01	3.02
Hopland	.77		.77					3.42						3.42
Redwood	2.66					2.66								
Ukiah	2.57		2.11	1.76			2.81	2.10			2.76		1.42	1.79
Contra Costa County	3.93				3.93			1.31				1.31		
Oakley	3.93				3.93			1.31				1.31		

APPENDIX TABLE 2

Weekly Average Percentage of Defects, by Weight, One Winery in Southern California, 1950

Area	Week ending									
	September 17			September 24				October 29		
	All wine	Golden Chasselas	Zinfandel	All wine	Mataro	Mixed	Grenache	All wine	Alicante	Mission
Southern California	1.51	.98	2.39	.57	.45	1.16	.39	2.25	2.52	2.04